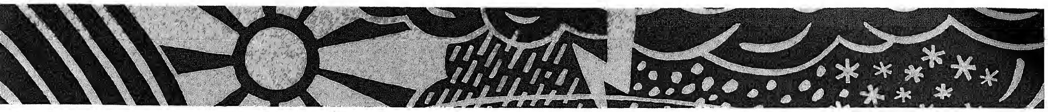


FOREWORD BY THE SECRETARY OF STATE FOR THE ENVIRONMENT

Earlier this year the Prime Minister signed the United Nations Framework Convention on Climate Change on behalf of the UK. This Convention was the culmination of many years of scientific and technical analysis by the international community, and two years of intense negotiations under the auspices of the United Nations General Assembly. I believe the Convention is a significant step forward in the international response to the threat of climate change.

The Convention has now been signed by over 150 nations. On entry into force it will commit developed country parties to draw up programmes of measures aimed at returning emissions of carbon dioxide (CO_2) *and other greenhouse gases to their 1990 levels by the year 2000. The Government will be working to ensure that the Convention is translated into effective international action. As part of this process we in Britain must now draw up our own programmes for implementing the Convention agreements. The first priority is* CO_2.

I do not believe that it would be right for the Government alone to determine the content of our CO_2 *programme. Businesses and individuals can make a significant contribution by their own actions. Nearly half of our* CO_2 *emissions are attributable to energy used by industry and commerce. Individual households (including private use of cars) account for a further 40% of national emissions.*

Through this discussion document I am inviting business to commit itself to taking action as part of our national programme. And I am seeking views on the scope for individuals to take further voluntary action. The more each sector of our economy can achieve through voluntary action to meet self-imposed targets, the less will be the need for Government intervention.

But the Government is not shirking its own responsibilities. We need to decide what action to take to supplement and support action by industry, commerce and households. The options are set out in this document. I invite views on this choice.

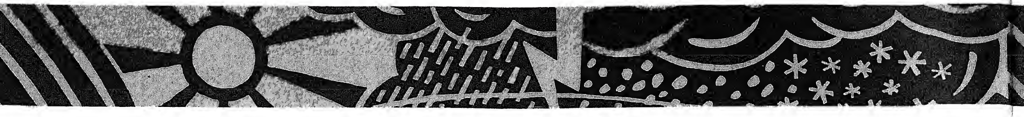
The overall aim must be to choose the most cost-effective combination of measures. Devising effective and efficient means of limiting emissions meets two goals. It will enable us to maintain, perhaps in some sectors of the economy even improve, our economic performance. And it can make it much easier to persuade other countries that they too should play their full part. I look forward to a full debate on these issues over the next three months.

Michael Howard

REFERENCE ONLY
THIS BOOK MAY NOT BE
TAKEN OUT OF THE LIBRARY

Rt Hon Michael Howard, QC MP

LIBRARY
UNIVERSITY



PREFACE

This discussion document is intended to stimulate public debate about the ways in which individuals, businesses and other organisations can contribute to the UK's national programme for limiting emissions of carbon dioxide (CO_2), the main greenhouse gas, up to the year 2000. The document does not discuss the effect of changes in the balance of fuels used in the electricity generating sector. These issues will be addressed in the light of decisions taken pursuant to the Coal Review announced by the President of the Board of Trade on 26 October.

Chapter 1 describes the main principles of the Climate Change Convention. Chapters 2 and 3 then look at the sources of CO_2 emissions in the UK and the prospects for the year 2000.

Chapters 4-7 describe the opportunities for individuals, businesses and public sector bodies to take action to reduce CO_2 emissions. Views are invited on the scope for voluntary action to contribute to the programme.

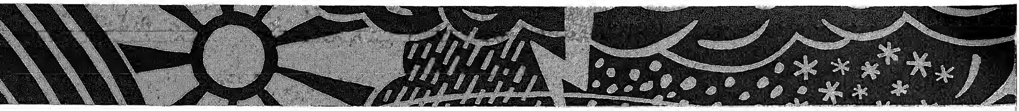
Chapter 8 describes the options for Government measures. A range of instruments is available. Economic instruments are likely to provide the most flexible and cost-effective way of encouraging action to limit emissions, although they may need to be supplemented by other measures directed at specific problems.

Respondents to this paper are invited to focus on the following specific issues:

- What can be achieved by voluntary action on the part of individuals to limit the emissions for which they are responsible (chapter 4)
- What can be achieved by business to limit the emissions for which they are responsible (chapter 5)
- How far can industry and commerce contribute by producing goods and services that help others to reduce CO_2 emissions (chapter 6)
- Insofar as further Government measures are needed, what measures are cost-effective and would best help individuals and businesses to reduce emissions (chapter 8)

Two copies of responses should be sent by 31 March 1993 to:
Ms C Jones
Department of the Environment
Global Atmosphere Divisionn
Room B247
Romney House
43 Marsham Street
London SW1P 3PY

The Department may wish to publish responses to this document in due course, or deposit them in the Libraries of the Houses of Parliament or the Department's library. We would include all responses, unless we are specifically requested to treat a response as confidential. Confidential responses will nonetheless be included in any statistical summary of numbers of comments received and views expressed.



CONTENTS

Chapter Page

1 THE THREAT OF CLIMATE CHANGE AND THE INTERNATIONAL RESPONSE 4
- Greenhouse Gases
- Improving Our Knowledge
- The Need for Precaution and International Cooperation
- The Convention's Approach
- The National Programme
- Monitoring

2 CARBON DIOXIDE EMISSIONS IN THE UK ~ SOURCES 6
- What Causes UK Carbon Dioxide Emissions?
- Current Emissions

3 THE PROSPECTS FOR CO_2 EMISSIONS TO 2000 7
- Trends in CO_2 Emissions
- The Savings Needed
- Combined Heat and Power
- Energy Efficiency

4 VOLUNTARY ACTION ~ THE INDIVIDUAL CITIZEN 10
- Underlying Trends
- Options for Action

5 VOLUNTARY ACTION ~ INDUSTRY & COMMERCE 13
- Underlying Trends
- Options for Action:
  - ~ Major Energy Users
  - ~ Light Industry, Commerce & Small Businesses

6 VOLUNTARY ACTION ~ PROVIDING ENERGY EFFICIENT PRODUCTS AND SERVICES 18

Chapter Page

7 VOLUNTARY ACTION ~ THE PUBLIC SECTOR 21
- Action Underway
- Options for the Future

8 OPTIONS FOR GOVERNMENT MEASURES 24
- Measures Outside the Transport Sector
- Transport
- Summary of Main Options for Government Measures

9 THE NATIONAL PROGRAMME 29
- Form of the Programme
- The Potential Contribution of Voluntary Action
- The Options for Government Measures
- Illustrative Combinations of Options

10 BEYOND 2000 31
- Renewable Energy
- Nuclear Power
- Transport

ANNEX: CURRENT ACTION TO REDUCE CO_2 EMISSIONS 33
- Current Action to help individuals to reduce emissions attributable to energy use in the home
- Current Action to reduce emissions attributable to energy use by industry and commerce, and the public sector
- Transport

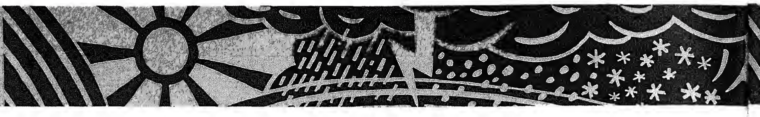
NOTES 35

LIST OF ABBREVIATIONS 36

FURTHER READING 37

FURTHER INFORMATION 37

one



THE THREAT OF CLIMATE CHANGE AND THE INTERNATIONAL RESPONSE

GREENHOUSE GASES

1.1 The Climate Change Convention is concerned with reducing the risk of climate change by limiting the increase in emissions of greenhouse gases. Many of these gases, such as carbon dioxide and methane, are already present in the atmosphere. They trap the sun's heat, warming the earth's surface and keeping the world habitable. However over the last hundred years the concentrations of some of these gases have begun to rise. Emissions from human activity, such as fossil fuel burning and widespread deforestation, are the main cause.

1.2 The concentrations of greenhouse gases in the atmosphere are now approaching levels unprecedented for at least the last 100,000 years, so there is no easy way of judging from the past what the effect of further increases in greenhouse gases would be. We can only use computer simulations. These need some of the world's largest and fastest computers - and the models of man-made climate change still need further development. Yet our objective must be, as identified in the Climate Change Convention, to ensure that the man-made greenhouse effect does not produce dangerous climate change, and that change does not occur at a rate too fast for natural eco-systems to adapt, or at a rate that would disrupt world food production.

IMPROVING OUR KNOWLEDGE

1.3 It must be our very first priority to improve our scientific knowledge of climate change. The scale of the scientific challenge means that it can only be met by an international effort. The Climate Change Convention has an Article dedicated specifically to international co-operation in assessing the possible changes to climate and the consequent impacts. The UK will be playing its full part through the work of the Hadley Centre at the Meteorological Office, and through the work of the Research Councils. However it is clear that it will take some ten to fifteen years for the main scientific uncertainties to be resolved. In that time world emissions of CO_2 may be 25% higher through the continued growth of the world economy and world population.

1.4 The UNEP/WMO Intergovernmental Panel on Climate Change has assessed the best evidence available. They have concluded that if emissions continue to grow at their current projected rates the world could begin to warm at some three times the rate seen in the past, that sea levels may begin to rise as the seas warm, and that rainfall and other regional climatic patterns may begin to move, with drying in some important areas of agricultural production. While we can begin to assess the global impacts of climate change, it will be some time before we can accurately predict national or even regional impacts.

THE NEED FOR PRECAUTION AND INTERNATIONAL COOPERATION

1.5 The Panel's report recognises the many uncertainties in these projections of the effect of continuing emissions of greenhouse gases, given our present state of knowledge. However, the gases concerned are intimately connected with human society. Emissions cannot just be turned off overnight if we experience unwanted climate change. This problem is compounded for some greenhouse gases such as carbon dioxide which, once released, remains in the atmosphere for very many decades. In the light of the scientific consensus that the threat of man-made climate change is both real and serious, precaution is necessary.

1.6 The control of greenhouse gases is not in the gift of any one nation. Even the largest emitter of carbon dioxide (the USA) only accounts for 24% of world emissions. The UK's contribution is barely 3% of world emissions. If we are to contain potentially damaging or dangerous changes to our climate, we must work together with all our global neighbours.

THE CONVENTION'S APPROACH

1.7 The Climate Change Convention reflects both the need to take a precautionary step by step approach, and the need for action at a global level. It requires all countries to take appropriate measures on the control of greenhouse gases. In particular developed country parties undertake to draw up national programmes with the aim of returning their emissions of each greenhouse gas to 1990 levels by 2000. In recognition of the need continually to reassess the developing state of scientific knowledge, the Convention sets the deadline of 1998 for a reassessment of the science and consideration of what future aims might be appropriate.

THE NATIONAL PROGRAMME

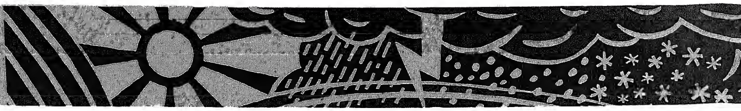
1.8 Britain continues to place importance on the acceptance by other countries of their Convention commitments so as to ensure effective action. At the G7 summit in Munich in July 1992 the leading industrialised countries urged other countries to join them in seeking to ratify the Convention, and in publishing their first national programmes under the Convention, by the end of 1993.

1.9 These programmes will need to cover all the Convention commitments, and all greenhouse gases. The first priority is to draw up a programme for limiting emissions of CO_2, the main greenhouse gas. In order to demonstrate that we will meet the Convention commitment, this programme must set out clearly the measures that will be taken to limit emissions and the effect these will have on emissions in the year 2000.

MONITORING

1.10 The Convention includes a requirement for periodic updating of national programmes. We will need to monitor the effects of the programme using energy consumption data to ensure that we remain on course and review the programme as necessary.

two



CARBON DIOXIDE EMISSIONS IN THE UK ~ SOURCES

WHAT CAUSES UK CARBON DIOXIDE EMISSIONS?

2.1 96% of the UK's man-made carbon dioxide emissions come from the burning of fossil fuels for energy use.[1] This discussion document looks at ways in which we might adjust our energy use in order to limit CO_2 emissions. The main fossil fuels are coal, oil and gas. However a given amount of energy consumption will lead to different CO_2 emissions depending on the fuel used. This is because different fuels vary in their carbon intensity. Coal is the most carbon intensive fuel, and gas the least carbon intensive.

2.2 Table 2.1 gives CO_2 emission coefficients for each of the main fossil fuel types. Most electricity is generated from burning fossil fuels at power stations so its use also gives rise indirectly to CO_2 emissions. The table includes an estimate of the average effective carbon content of electricity, based on the current pattern of fuel use for electricity generation.

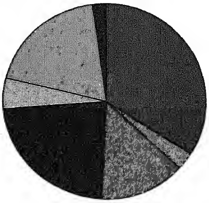
Table 2.1:
Emission Coefficients

1990	kgC/kWh
Gas	0.06
Oil	0.08
Coal	0.09
Coke	0.10
Other solid fuel	0.13
Electricity	0.20

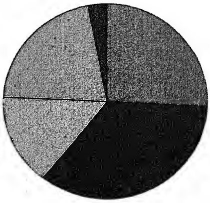
CURRENT EMISSIONS

2.3 CO_2 emission estimates are derived from energy consumption data. UK CO_2 emissions in 1990 totalled 160 million tonnes of carbon (MtC)[2]. Table 2.2 shows UK CO_2 emissions in 1990 by source (that is according to where the fuel is first used). For households, industry and agriculture, and the commercial and public sectors, this excludes emissions attributable to their use of electricity. Table 2.3 shows emissions in 1990 with power station, refinery and other fuel processing emissions attributed to the end users of the energy.[3]

CO_2 Emissions: by Source



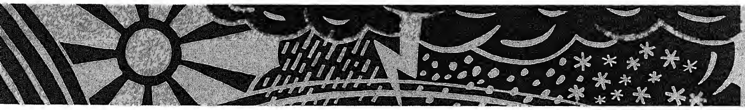
CO_2 Emissions: by Final Energy Consumer



CO_2 Emissions, 1990[4]

	Table 2.2: by Source		Table 2.3: by Final Energy Consumer	
	MtC	%	MtC	%
▮ Power Stations	54	34	–	–
▮ Refineries	5	3	–	–
▮ Households	22	14	41	26
▮ Industry and agriculture	37	23	56	35
▮ Commercial and public sector	8	5	24	15
▮ Road transport	30	19	33	21
▮ Other transport[5]	4	2	5	3
TOTAL	160		160	

2.4 Just over half of transport emissions in 1990 were accounted for by private use of cars and over a quarter by industrial, commercial and public sector use of road transport (see table 9.1).



three

THE PROSPECTS FOR CO$_2$ EMISSIONS TO 2000

TRENDS IN CO$_2$ EMISSIONS

3.1 Changes in CO$_2$ emissions depend on changes in energy consumption and in the types of energy used.

3.2 Changes in energy consumption are related to changes in economic activity, but the relationship is not straightforward. Over the last 100 years the UK has experienced a decline in the amount of energy used to produce a given amount of economic output (the energy: GDP ratio). This has been the result partly of the gradual shift in output from highly energy intensive activities (eg heavy engineering) to less energy intensive activities (lighter manufacturing industries and services), and partly of the gradual improvement in energy efficiency as a consequence of technological change and the continuing modernisation of capital equipment.

3.3 Overall the energy: GDP ratio has improved at a rate of about 1.25% a year since 1945, improving more quickly at times of high energy prices (eg in the mid to late 1970s) and less quickly at times of low energy prices. This improvement is expected to continue over the decade to 2000, but the rate of improvement will continue to depend to some extent on the level of energy prices.

3.4 The type of energy used is also important given the differences in carbon intensities between energy types (see table 2.1). In the past, a shift from coal to gas use by householders has helped to reduce CO$_2$ emissions. This is now levelling off. Differences in the balance of fuel used in the electricity generating sector can significantly affect CO$_2$ emissions. With current technology, generating electricity from gas produces about half the CO$_2$ emissions per unit of electricity compared with generation from coal. The growth in energy used for road transport as a proportion of total energy demand is also an important factor as the only fuels currently widely used for transport are derived from oil.

3.5 Projections of energy demand and CO$_2$ emissions under a range of assumptions about future economic growth and energy prices were published in 1989 in Energy Paper 58. These were revised during 1991 and the revised projections published as Energy Paper 59 (EP 59).

3.6 The range of emissions given in EP 59 for the year 2000 is 157 to 179 MtC, compared with emissions in 1990 of 160 MtC. On the basis of EP 59, a projection of around 170 MtC, corresponding to the central growth scenario combined with the lower energy price assumption, would be a reasonable baseline for our national programme. However some of the assumptions underlying these projections will come under scrutiny in the Coal Review and, in monitoring progress with the national CO$_2$ programme during the 1990s, we will need to keep the underlying projection under review. Changes in long-run trends in economic growth rates or exogenous changes in energy prices (which are unpredictable) could change the underlying trend in emissions. Since EP 59 was prepared agreement has been reached on the establishment of a new Energy Saving Trust (see page 25). This could reduce emissions by 2-3.5 MtC by 2000.

Table 3.1: Emission projections by sector under the central scenario in EP 59 [6]

million tonnes carbon (MtC)

	1990	1995	2000	2005	2020
Households	41	39	41	42	42
Industry/agriculture	56	56	58	61	71
Commercial/public	24	23	26	30	45
Transport	38	41	45	49	62
TOTAL	160	159	170	183	221

THE SAVINGS NEEDED

3.7 Savings can in principle be made in three ways: switching to less carbon intensive sources of energy, supplying delivered energy more effectively (particularly through the use of combined heat and power), or using less energy at the point of final use (eg by improving the energy efficiency of appliances and processes). This Discussion Document looks at the options for individuals, businesses and the public sector to curb CO_2 emissions by improving energy efficiency, and the options for Government measures to support such activity.

COMBINED HEAT AND POWER

3.8 In conventional electricity generation some 50-70% of the fuel input is rejected as heat to the atmosphere. By using combined heat and power (CHP) much of this heat can be recovered and hence the energy can be supplied about twice as efficiently. The heat can be used for industrial processes or for heating buildings. CHP has a significant potential to reduce CO_2 emissions, perhaps by as much as 10%. CHP currently comprises 3% of UK electricity generation. The Government's current objective is to double that capacity to 4000 MW by the year 2000. The ultimate potential could be as high as 20,000 MW.

ENERGY EFFICIENCY

3.9 There is considerable scope for further improvements to be made in the efficiency with which energy is used. Improved energy efficiency would allow energy consumption to be reduced without affecting the output of goods and services or the living conditions of households. Much investment in energy efficiency is cost effective, that is the value of the savings from reduced energy consumption outweighs the cost of the initial investment in present value terms. Such investments can therefore bring environmental improvements through reduced emissions at no net economic cost.

3.10 The potential for cost-effective energy efficiency savings is estimated at 20% of current energy consumption outside the transport sector, equivalent to 24 MtC. We might realise just over one third of this potential (about 9 MtC) through the continuation of current policies and trends. These will include improvements arising as householders invest to modernise their properties and as industry, commerce and the public sector invest to cut costs and increase the efficiency of their operations, and the impact of the Energy Efficiency Office's continuing programmes of information, advice and grants, which encourage such investment to take place. The EP 59 CO_2 projections incorporate these savings.

3.11 However it should be possible to find ways of exploiting the remaining potential of up to 15 MtC for cost-effective energy efficiency improvements. This would enable us to find a significant part of the savings likely to be required by our Convention commitments at no net economic cost. This requires action by everybody. Government action already underway is summarised in the Annex, but the Government, acting alone, cannot ensure that the potential for savings which exists in every sector of the economy is realised. This document therefore looks first at the scope for individuals, businesses and public sector bodies to take action themselves to cut their energy bills by investing in more efficient products and in energy saving measures, or to switch to less carbon intensive fuels (chapter 4-7). Chapter 8 then looks at further possible Government measures which might be taken to supplement or support such voluntary action. Chapter 9 looks at how these options might be put together to contribute to a national programme that will meet our Convention commitment. Chapter 10 then looks at the prospects beyond 2000.

four

VOLUNTARY ACTION ~ THE INDIVIDUAL CITIZEN

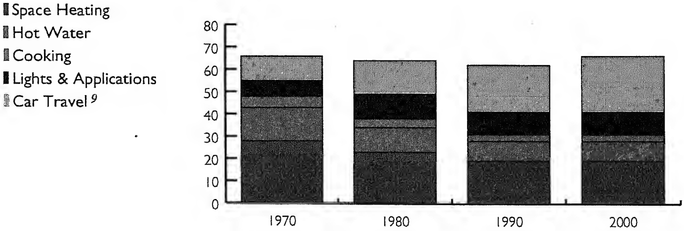
UNDERLYING TRENDS

4.1 Energy use by individuals accounted for nearly 40% of total UK CO_2 emissions in 1990. Over 25% of all UK CO_2 emissions are directly or indirectly attributable to energy use in the home (chiefly electrical appliances, heating and hot water). Private car travel (excluding use for business mileage) contributes a further 13% of total UK CO_2 emissions.

4.2 The illustration below shows trends in CO_2 emissions due to individuals' energy use.[7] Although energy consumption in the home rose by about 10% between 1970 and 1990, CO_2 emissions fell by almost one-fifth, due to increased use of natural gas as a domestic fuel, and fuel switching and improved efficiency within the electricity supply industry.

4.3 On unchanged policies CO_2 emissions attributable to energy use in the home are expected to remain broadly constant between 1990 and 2000, as increased energy consumption is offset by fuel switching from coal to gas in the electricity supply industry. (This assumption will come under scrutiny in the Coal Review.) By contrast, CO_2 emissions from private car travel are expected to rise by some 19% between 1990 and 2000 on a central projection.

Analysis[8] of household CO_2 emissions (MtC) 1970-2000



Can we continue the past trend of falling emissions from energy use in the home?

What can be done to limit emissions from cars?

What contribution can individuals make to the national programme?

OPTIONS FOR ACTION

4.4 The EP 59 projections include the effect of continuing improvements in the insulation standards of housing and in the energy efficiency of domestic appliances. But there is potential to achieve a further 4-5 MtC saving in CO_2 emissions through cost effective improvements in energy efficiency. Individuals could be encouraged to do more, and to think more carefully about their transport choices. There is growing awareness and concern for the environment. Many people want to help to tackle the threat of global warming but do not know how.

4.5 The Energy Efficiency Office's "Helping the Earth Begins At Home" campaign is explaining to householders how they can improve the energy efficiency of their homes. Literature is available to explain the various energy efficiency measures that can be taken and the extent to which these reduce fuel bills and CO_2 emissions.

4.6 Consumer groups, environmental, housing and transport organisations, local authorities and energy utilities all have a valuable role to play in raising public awareness of the issue, and providing advice on how to achieve energy savings. The providers of energy efficiency goods and services and energy using machines and appliances need to back this up by making good quality products readily available to householders. The Government plans to encourage the participation of local authorities and the voluntary sector in any local information centres set up through the Energy Saving Trust (see paragraph 8.7).

4.7 Possible action that voluntary groups, businesses and other organisations might take includes:

a. Encourage individuals to take up the advice of the "Helping the Earth Begins At Home" campaign (see below).

b. Encourage individuals to obtain home energy labels, for example *energy utilities, mortgage lenders and estate agents* could make home energy labels available as part of their commercial activities.

c. Encourage people to buy the most energy efficient model when they are purchasing new electrical appliances for their home.

d. Encourage individuals to calculate themselves how much CO_2 they use. The booklet produced by the Association for the Conservation of Energy (ACE) with the Worldwide Fund for Nature (WWF) and the Consumers Association in 1991 called "The Greenhouse Effect and You" is one example of how voluntary groups can help individuals. It helps individuals to calculate annual CO_2 emissions and suggests ways in which emissions can be reduced by 20-30% over a few years.

Helping the Earth Begins at Home Campaign

10 Things You Can Do At Home (in cost order)	Typical cost (one-off payment) £	Typical annual CO_2 savings kg	Typical annual saving £
• Only use the heat, lights and appliances you need (eg turning the thermostat down 1°C can save around 10% of the heating bill)	0	190 to 500	15 to 40
• Lag your hot water tank	5 to 10 *	125 to 190	10 to 15
• Lag your hot water pipes	5 to 10 *	60 to 125	5 to 10
• Use low energy light bulbs	8 to 17	150	12 (for 2000 hrs per year use)
• Add to your heating system:			
- Thermostat	10 to 15 *	125 to 250	10 to 20
- Thermostatic radiator valves	45 to 75 *	125 to 250	10 to 20
- Timer/programmer	35 to 45 *	250 to 320	20 to 25
• Fit draught-proofing to windows and doors	45 to 60 *	125 to 250	10 to 20
• Loft insulation should be 6" thick**			
- DIY	110 to 160 *	750 to 880	60 to 70
- Contractor	190 to 300	750 to 880	60 to 70
• Install plastic secondary double glazing	120 to 600 *	190 to 320	15 to 25
• If you have cavity walls, seek advice on cavity wall insulation**	300 to 500	750 to 880	60 to 70
• If you have an old central heating boiler, fit an energy efficient condensing boiler**	400 to 600 † (extra cost compared with ordinary boiler)	1250 to 1700 (compared with old boiler)	100 to 130 (compared with old boiler)

* DIY costs shown for these items

** Installing these items will lead to the most significant cuts in your fuel bills and in CO_2 emissions

† Cost shown for gas condensing boiler, but oil-fired model also available

A home energy survey can give you valuable information on how to improve the energy efficiency of your home and how much it might cost.

e. Encourage individuals to make commitments to reduce their energy and fuel consumption. The "Tree of Life/Pledging for the Planet" initiative to raise public awareness of the issues relating to the Earth Summit in June 1992 was supported by over 50 non-governmental organisations in the UK and assembled in Rio de Janeiro during the Earth Summit. It included pledges on energy and transport use as follows:

> *Energy: I will use 10% less gas and/or electricity in my home during the next year.*
>
> *Transport: I will cut my car mileage by 10% during the next year. I will walk, cycle or use public transport wherever possible.*

f. Encourage individuals to cut down on their use of cars by walking, cycling or using public transport where possible.

g. Where it is necessary to use a car, people could be encouraged to think about how they could drive more fuel efficiently (savings of up to 15% of CO_2 emissions from cars are possible from better driving alone). Ways to raise public awareness of fuel efficiency need to be considered. *Car manufacturers* could launch national and local competitions for fuel efficient driving (see also chapter 6).

h. People could also be encouraged to buy a more fuel efficient car when they are considering buying a car. The Department of Transport's "New Car Fuel Consumption" guide gives more information on fuel efficient cars and driving techniques.

i. As part of the work on environmental geography and science, the National Curriculum includes items on energy and energy efficiency. This gives teachers an opportunity to introduce ideas on global warming and the effective use of energy. School children can carry out energy audits of their classrooms and their homes (including use of transport). Targets can be set to reduce energy use, and progress monitored by calculating both savings of CO_2 emissions and money. Many voluntary organisations and local authorities are actively engaged in environmental education and the DOE/EEO, in partnership with the private sector, promote the teaching of energy efficiency in schools, through CREATE, a body set up by Government and the private sector to promote the teaching of energy efficiency in schools.

4.8 Chapter 8 looks at possible Government measures which might help to support such activity to reduce emissions from homes and private use of cars.

Your views would be welcome

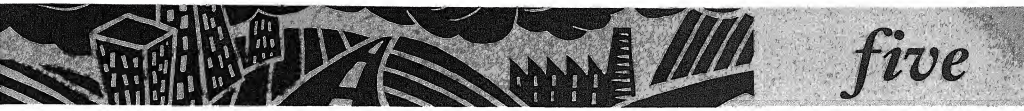
What objectives should be set for emissions from energy use in the home?

What objectives for emissions from cars?

What contribution can consumer groups and environmental and other voluntary groups make?

What part should Government play?

How can we best keep track of progress towards our objectives and ensure that we stay on track?



five

VOLUNTARY ACTION ~ INDUSTRY & COMMERCE

UNDERLYING TRENDS

5.1 Energy use by industry and commerce accounted for almost 50% of all UK CO_2 emissions in 1990. Of this most was accounted for by process energy, heating, lighting and appliances. But company transport fleets (cars, commercial and goods vehicles) contributed about 10% of CO_2 emissions in industry and commerce.

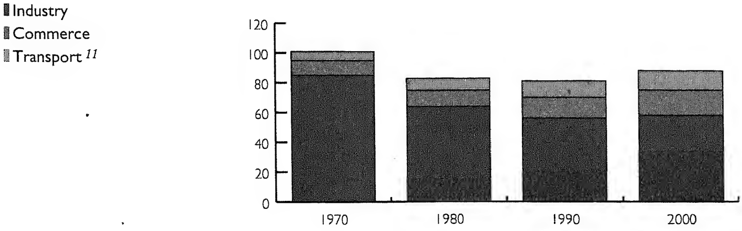
5.2 The illustration below shows trends in emissions attributable to energy use by industry and commerce.

5.3 *Industry* Emissions from the industrial sector have been falling steadily over the last 20 years, even though industrial output has remained fairly constant. Structural change and improvements in energy efficiency are notoriously difficult to disentangle, but since the second oil crisis a significant proportion of this improvement appears to have been due to improvements in energy efficiency[10]. Emissions are however projected to increase to 2000 on the central scenario in EP 59, even assuming that the trend in energy efficiency improvements continues.

5.4 *Commerce* Commercial sector emissions have been steadily rising and are projected to continue to rise. Work is in hand at the Building Research Establishment (BRE) to analyse the reasons for these increases. Likely causes include sectoral expansion, increased use of air conditioning, higher lighting standards and more office equipment.

5.5 *Transport* Emissions from the company transport fleet are rising and are expected to continue to rise at a faster rate than non-transport emissions.

Trends in industry and commerce CO_2 emissions (MtC) 1970-2000



5.6 In industry, process energy and drive power account for over three quarters of emissions. In commerce the chief source is energy used for space and water heating and air conditioning.

Industry

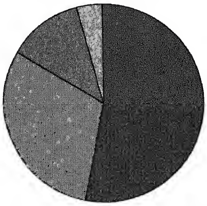
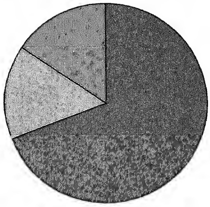


Table 5.1: CO_2 Emissions from Energy used in Industry and Commerce, 1990, by purpose

	MtC	
	Industry	Commerce
▮ Process energy	26	NA
▮ Drive Power	15	NA
▮ Space & water heating	6	9[12]
▮ Lighting	2	2
▮ Appliances	NA	2
TOTAL	49[13]	14

Commerce



OPTIONS FOR ACTION

5.7 On continuation of past trends, industry and commerce are expected to save some 4-5 MtC through improvements in energy efficiency by 2000. These savings have been incorporated in the emission projections. However double these savings are potentially available through actions which are cost-effective.

Major Energy Users

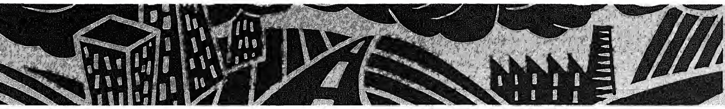
5.8 Major energy users including the energy intensive industries and large commercial organisations such as large retailers, will generally already be aware of the need to improve their energy efficiency. They have been encouraged to take action by the EEO's Best Practice Programme and, under the Making a Corporate Commitment Campaign, they are being encouraged to set targets for improvements in their energy efficiency and to ensure that energy efficiency is considered regularly at boardroom level. Many businesses will also have drawn up environmental policy statements. Energy efficiency should be a key part of these statements.

5.9 The energy intensive industries have a particular concern with their energy bills because these form a significant proportion of their costs. In 1990, five energy-intensive industries accounted for 55% of all non-transport emissions from industry and commerce. These industries are:

Table 5.2: Emissions from Energy Intensive Industries

		MtC	
	1970	1980	1990
Iron and Steel	22	9	9
Other Metals	13	12	9
Mineral Products[14]	7	5	4
Chemicals	10	10	9
Paper and Board	4	3	3
TOTAL	56	39	34

5.10 Technological improvements, process change and fuel switching to less carbon intensive fuels, have resulted in emissions from these industries being some 20 MtC lower than they would have been using 1980 energy intensities, taking account of the generally higher 1990 production levels. However the trend rate of reductions in CO_2 emissions in the energy intensive sector has been no greater than the average for industry overall - 35% over the last 20 years.



Iron and Steel Industry: ETSU have estimated that iron and steel industry emissions in 1990 would have been 14MtC instead of 9 MtC, using 1980 technology for 1990 production levels, if energy efficiency improvements had not taken place. Process change has also played a part. Steel making has become 12% more energy efficient, blast furnaces 9% and coke making 14%; and the transfer of a further 56% of capacity from ingot to continuous casting has been responsible for a reduction of 3% in total iron and steel industry energy use.

Can more be expected of this industry? In Japan much greater use is made of the steel process industry off-gases. It is estimated that further use of this fuel in the UK could result in additional energy savings of 1.5%.

5.11 Possible action by major energy users might include:

a. Major energy using businesses or even whole industries could *declare targets for reducing CO_2 emissions through improved energy efficiency* if they have not already done so. These could be on an individual company or a sectoral basis. They would need to take account of the different carbon intensities of different energy sources (see chapter 2). The Making a Corporate Commitment Campaign encourages companies to make a commitment to responsible energy management at board level and to set performance improvement targets. The Advisory Committee on Business and the Environment (ACBE) Global Warming Working Group has also recommended that major energy using industries should set themselves targets for energy efficiency improvements over the next five years.

Can major energy users increase their rate of energy efficiency improvement?

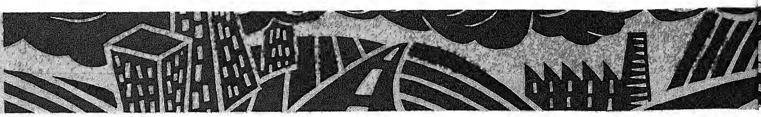
How does the scope for improvement vary between sectors?

IBM: In 1984 IBM set itself a corporate target of achieving a 20% energy saving over five years. In fact IBM UK achieved over a 25% saving, worth £2.5 million to the company. In 1990 the company set a further target as part of its corporate environmental policy. The target is to save a further 4% in energy consumption year on year to 1994. In 1991, IBM UK made savings worth nearly $1 million in the UK and nearly $23 million worldwide through energy conservation measures.

This sort of approach is also being pursued in other countries. The Dutch Government has agreed a 20% efficiency improvement target with Dutch industry, through the use of long-term sectoral agreements. By June 1992, 25 industry sectors had made a long-term agreement, with a further 8-10 more expected later this year. In Canada, the Government has established an Advisory Council on industrial energy efficiency. This will include leaders from all major energy intensive industries and aim to help stimulate the development and implementation of private sector initiatives to set and achieve new energy efficiency targets.

b. Major transport users could *review their company transport policies* for both commercial/freight and employee car use, and encourage employees to use public transport rather than company or private cars wherever possible. There are a number of sources of advice. The Best Practice programme run by the Energy Efficiency Office has supported work on energy efficiency in freight transport by demonstrating and promoting aerodynamic trucks. It has also published an advisory booklet (Fuel Efficiency Booklet No. 20 - Road Transport - available through the EEO and ETSU). A Fuel Management Guide is available through the Freight Transport Association.

The ACBE Global Warming Working Group has published a Guide to Environmental Best Practice for Company Transport. The Guide is being issued to over 900 companies who have signed the "Making A Corporate Commitment" campaign.



c. Major businesses in large urban areas could introduce local schemes to fund shared or public transport for their employees, perhaps in cooperation with local public transport providers, or could encourage car pooling. ACBE have suggested that employers should seek to discuss with British Rail and London Transport ways of overcoming the barrier of the high marginal cost of using public transport compared with using cars, for example by paying a standing charge in return for discounted tickets or seeking bulk discounts for company travel.

d. Major businesses/industry could consider switching to fuel sources which emit less CO_2; or using combined heat and power schemes, which could reduce CO_2 emissions by over 50% compared with conventional electricity generation plant.

Light Industry, Commerce & Small Businesses

5.12 For smaller businesses energy may represent a smaller proportion of total costs. However overall these businesses make a significant impact on CO_2 emissions in the industrial and commercial sector. For example small companies employing less than 500 people account for 45% of the total manufacturing energy bill. Small businesses will therefore wish to consider how they can contribute to reducing CO_2 emissions by improving the efficiency with which they use energy - and benefit from the significant savings which will result. Small businesses, after taking professional advice and making well-chosen investments with 2-4 year pay backs, may achieve savings of 20-40% on their energy bills.

5.13 Table 5.3 below shows trends in emissions from light industry and commerce (excluding transport).

Table 5.3: CO_2 Emissions from Light Industry and Commerce

		MtC	
	1970	1980	1990
Light industry	20	16	14
Commerce	10	11	14
TOTAL	30	27	28

Can light industry, commerce and small businesses exploit the remaining potential for cost effective savings available?

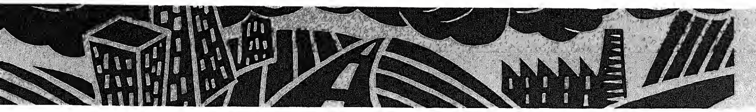
What role could the CBI, IOD, BiE, Chambers of Commerce, and trade associations play in helping these businesses achieve these savings?

5.14 Historically CO_2 emissions from light industry have declined whilst those from commerce have increased. Energy efficiency has improved both in light industry and in the commercial sector, where energy consumption per unit output in 1990 is about 60% of its 1970 level. Fuel switching has also helped. However in the commercial sector the increasing trend for modern electrically powered office equipment (photocopiers, facsimile machines, computers and word processors) and for air conditioned and artificially lit offices has led to a rise in emissions.

5.15 These trends are likely to continue over the next decade. However further CO_2 savings could be achieved by 2000 through cost-effective improvements in energy efficiency.

Food and Drink Industry

Whilst the output of food during the 1980s has increased by some 10%, the total energy consumed by the sector fell by 12%. This was a direct result of improvements in energy efficiency and the development and rationalisation of plant. These savings together with fuel switching have led to emission reductions of 0.2 MtC since 1980 and 0.6 MtC since 1970.



5.16 Actions which are particularly relevant to small businesses include:

a. Taking up the recommendations in the Energy Efficiency Office/Advisory Committee on Business and the Environment "Practical Energy Saving Guide for Smaller Businesses".

b. Utilising the EEO's 'Best Practice' programme which can help to increase the adoption of energy efficient technologies and techniques, including management techniques.

c. Raising the awareness of energy efficiency amongst employees and the environmental benefits. For example, the Department of the Environment has recently produced a "Green Housekeeping Policy Statement" which was issued to staff in a leaflet listing things to do to save energy and other resources. An action plan has been produced and will be senior managers' means of ensuring that the aims of the statement are met. Other initiatives include displays, posters, and the use of "fillers" in staff bulletins and notices.

d. Using the Energy Management Assistance Scheme. This Scheme, which has been introduced to encourage smaller businesses (ie those employing less than 500 people) to invest in energy efficiency, offers assistance towards project management costs.

5.17 Chapter 8 sets out possible Government measures to help achieve further savings in the industrial and commercial sector.

Your views would be welcome

What objectives would major energy users be willing to set themselves for emissions in 2000?

Would different sectors of major businesses want to set different objectives?

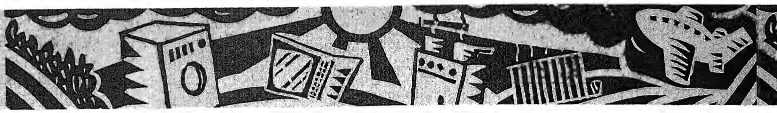
What might be a reasonable overall objective for light industry and commerce?

What actions can industry and commerce take itself?

What part should Government play?

How can we best keep track of progress towards our objectives and ensure that we stay on track?

six



VOLUNTARY ACTION ~ PROVIDING ENERGY EFFICIENT PRODUCTS AND SERVICES

6.1 Industry and commerce have an important role to play as providers of goods and services that can help us to reduce CO_2 emissions. These include products, such as insulation materials, whose purpose is specifically to improve energy efficiency. But other products are also important. All energy using machines and appliances can help to reduce CO_2 emissions if they are designed to be as energy efficient as possible. And recycling of fossil derived products, such as plastic, and products whose production is energy intensive, such as glass and aluminium, can help to reduce CO_2 emissions. The energy utilities and their regulators have a special role to play, given their responsibilities for supplying energy and their duties to promote energy efficiency.

6.2 The following is a list of issues to consider:

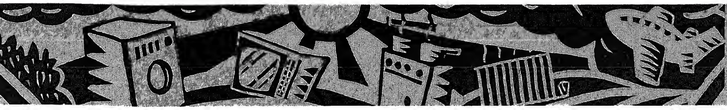
a. **Appliances:** A report commissioned by the Energy Efficiency Office on "Energy Efficiency In Domestic Electric Appliances"[15] suggested that energy savings of up to 40% could be achieved if customers were to replace their existing appliances with the best already available in UK shops. While immediate replacement of all existing appliances would not be cost-effective the report shows the scale of savings potentially available from ensuring appliances are manufactured to the highest standards of energy efficiency.

The Consumers Association, in their evidence to the House of Commons Energy Committee in October 1990, argued that West German and Scandinavian manufacturers put more emphasis on energy efficient appliances. This may give them a competitive advantage as this factor gains in importance. In Germany, standard setting bodies are being required to take greater account of the need to limit CO_2 emissions. The United States introduced energy efficiency standards for washing machines, driers and dishwashers in 1991.

Since energy efficiency standards for appliances would relate to traded goods, action by individual European Community Member States would be likely to conflict with the fundamental Treaty obligations on the free movement of goods, and thereby lead to disguised restrictions on trade. Consistent with the principle of subsidiarity the UK is pressing for agreement in the European Community on minimum energy efficiency standards for a wide range of equipment. At present the European Commission is seeking to negotiate such standards on a voluntary basis with the manufacturers. However, if satisfactory progress is not made, the Government will both press and help the Commission to develop regulations prescribing compulsory minimum standards.

Are manufacturers confident that all their appliances would meet these standards? Could industry do more to promote energy efficient appliances?

b. **Appliance labelling** is a logical first step. It will enable consumers to make informed choices when purchasing new appliances and will encourage manufacturers and retailers to improve the efficiency standards of appliances they sell. The UK Government has argued in the Community for a Directive requiring a compulsory EC-wide appliance labelling scheme. Discussions on the Directive are progressing well, but the EC scheme is unlikely to be operational before the beginning of 1994. The Government therefore introduced a voluntary UK scheme last November. At present, labels are displayed on fridges and freezers for sale in the showrooms of the regional



electricity companies, but the Government hopes the scheme will be extended to other appliances and taken up by other retailers in the near future. The development of these labelling schemes should lead to improved levels of energy efficiency of appliances.

c. The **lighting industry** is a good example of what can be achieved by technology. Significant progress in lighting efficiency has been made by the introduction of electronic ballasts for fluorescent lights, cheap and efficient reflectors and compact fluorescent light bulbs. The market penetration of the latter has increased substantially but there are still significant savings to be had from ensuring that all buildings benefit from improved technology.

In the Netherlands, the energy utilities funded a nation-wide energy efficient light-bulb drive in autumn 1991. A design contest for fittings was organised, a quality mark was established, and a 'green corner' was set up in retail outlets to explain suitable fittings to customers. The bulbs are sold against a deposit payable on return of fused bulbs, to ensure responsible disposal of the light-bulbs.

In the US major institutions (businesses and government and other organisations) are being encouraged to sign a Memorandum of Understanding with the Environmental Protection Agency under the "Green Lights Program". Signatories commit to install energy efficient lighting in 90% of their space over a five year period.

What further action could be taken by the lighting industry or by the energy utilities to promote the use of energy efficient lighting?

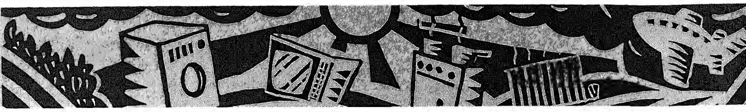
d. **Building Standards:** The revised building regulations which came into force in 1990/91 require the energy efficiency of space and water heating to be improved by about 20% compared with previous requirements. The aim is to achieve similar savings by tightening the provisions of the Regulations further in 1993/4. Many other countries, including Canada, Germany and the Netherlands, also have plans to tighten standards for insulation and efficiency in heating systems in the building sector. *Builders could at very modest cost go beyond Building Regulation standards* and give themselves a valuable marketing advantage - some already do so.

e. **Insulation manufacturers and installers:** Insulation manufacturers and installers need to continue working to find ways of reassuring consumers that their products and services are subject to quality control checks and guarantees, and that installers are properly trained. *What plans does the industry have for meeting consumers' concerns?*

f. **The Energy Saving Trust** has been set up by British Gas, the Regional Electricity Companies and the Government to run new energy saving schemes for householders and small businesses (see chapter 8). *What schemes should this be funding?*

g. **Car manufacturing industry:** The Society of Motor Manufacturers and Traders (SMMT) have set themselves a voluntary fuel efficiency target of a 10% improvement in fuel efficiency by 2005 through improved technology. They are considering if this target can be improved, not just through technology improvements but by other means. Germany is establishing improvements in average fuel consumption of cars of various classes aiming to achieve an average of 5-6 litres per 100 km by the year 2005. Japan aim to improve fuel consumption through reduced weight, better aerodynamics, as well as the development and adoption of hybrid engines and ultra lean burn systems, and have set energy efficiency improvement targets for motor manufacturers. *Can the industry adopt a more challenging target?*

There has been much debate about the role of diesel cars in helping to achieve a significant reduction in CO_2 emissions. Although diesel cars produce significantly less



CO$_2$ emissions than petrol cars, they produce more of other emissions which affect local air quality. In Japan, regulations on NOx have been strengthened. *Can car manufacturers improve the emissions performance of diesel cars?*

h. It is estimated that ***fuel efficient driving*** could reduce CO$_2$ emissions from cars by some 15% (or 3-4 MtC). The Advisory Committee on Business and the Environment (ACBE) suggested in its Second Report that car manufacturers might sponsor advertisements and national competitions for economical driving to promote greater public awareness of fuel efficiency and driver behaviour. *Could this be done?*

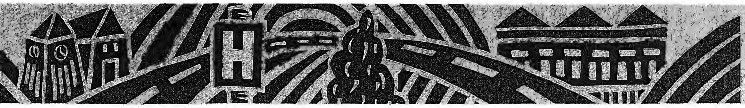
i. Those responsible for the manufacture, purchase and operation of **public transport vehicles** can ensure that these are as fuel efficient as possible.

j. A number of **energy awards** are funded by the private sector as a way of raising the awareness of energy efficiency. For example, British Gas runs the Gas Energy Management Awards to encourage efficient use of gas. The electricity companies run the Business Energy Awards to encourage the efficient use of electricity, the Lighting Industry Federation runs EMILAS to encourage efficient lighting, and the Major Energy Users Council and NIFES jointly give awards for good energy management techniques. *How can these competitions evolve to reflect the need to reduce CO2 emissions?*

The Royal Society for Nature Conservation have, with sponsorship from British Telecom, established an award called "Environment City", which assesses bids on eight criteria, including energy efficiency and transport. In Canada, a voluntary corporate leaders programme - Energy Innovators Venture - has been established to encourage Canadian corporations, cities and towns, to implement energy efficient and alternative energy technologies.

k. **Recycling:** The use of recycled materials in production rather than virgin materials can often save energy. In the case of materials such as glass and aluminium, that saving is clear but recycled plastics, paper and board, metals and textiles can also yield significant energy savings. Manufacturers whose production processes could use secondary raw materials rather than virgin materials may wish to set targets for their use (although they will need to consider the wider environmental impact of doing so). Other organisations could set procurement targets for the use of products made from recycled materials.

The other area in which industry can assist recycling and save energy in the process is through designing for recyclability. For instance, products are more readily recycled if they contain suitable glues or avoid mixing polymers.



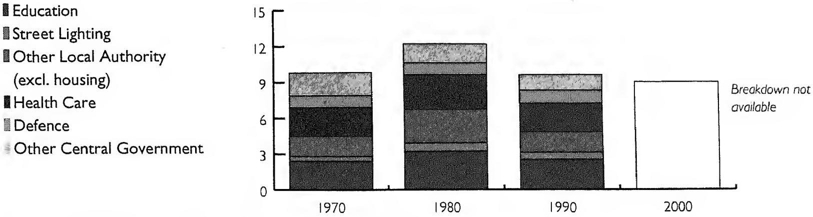
seven

VOLUNTARY ACTION ~ THE PUBLIC SECTOR

ACTION UNDERWAY

7.1 The public sector has provided a lead in adopting targets for improving energy efficiency. Plans need to be drawn up to ensure these targets are met.

7.2 In 1990 the public sector was responsible for 9.6 MtC, or about 6% of all UK CO_2 emissions. The breakdown is illustrated below.



7.3 In addition the public sector is responsible for emissions from its use of transport.

7.4 The potential for emissions abatement is thought to be between 20% and 30% for energy efficiency measures with a high return. This corresponds to between 2 and 3 MtC. Some but by no means all of this will be achieved on current trends.

7.5 Many public sector bodies have now adopted targets for improvements in energy efficiency. These include:

a. Departments in the Government Estate are required to achieve annual savings in their energy consumption rising to 15% over a 5 year period to 1995/96. This is expressed in terms of cost per unit of heated floor area, based on standard fuel prices. "Green" Ministers monitor their Department's progress in improving energy efficiency performance and are responsible for ensuring that the 15% savings target is achieved. Returns are made showing trends in the use of different fuels to allow CO_2 savings to be calculated. Progress has so far been limited but the 15% energy saving target is expected in due course to result in CO_2 savings of 0.4 MtC. All Government Departments have signed up to the Making a Corporate Commitment Campaign.

b. Local Authority Associations have endorsed a target for local authorities of reducing energy consumption in their own buildings (schools, libraries, sports and leisure facilities, administrative buildings) by 15% over a 5 year period. This should save about 0.7 MtC by 2000.

c. Health Authorities in England have agreed a target to reduce their energy consumption by a further 15% over a 5 year period. This should save about 0.4 MtC by 2000.

Some of these savings are already taken into account in the projections but overall these targets, if achieved, will result in an additional 0.7-0.8 MtC saving in CO_2 emissions.

OPTIONS FOR THE FUTURE

7.6 The following are possible further actions:

a. The various organisations which have entered into energy saving commitments will need to be able to demonstrate that they are meeting them. This may require them to bring forward some capital investment but this should all be justifiable on the basis of the resulting cost savings.

b. Consideration may have to be given to *further targets extending to the year 2000.* In the United States Federal Agencies are required to reduce energy consumption in Federal buildings and facilities by 20% by 2000.

c. Like industry and commerce public sector bodies need to consider ways to improve *fuel efficiency in their vehicle fleets*. For example the United States Federal Agencies are required to reduce fuel consumption in Federal vehicles by 10% by 1995 and to maximise the purchase of alternative fuel vehicles in their fleets. The ACBE "Guide to Environmental Best Practice for Company Transport" provides useful advice for companies which will be relevant to public sector bodies (see chapter 5).

d. All Public Sector Bodies should sign up to the EEO *"Making A Corporate Commitment"* campaign for top management.

e. Public Sector Bodies should produce *environmental strategies* for "good housekeeping".

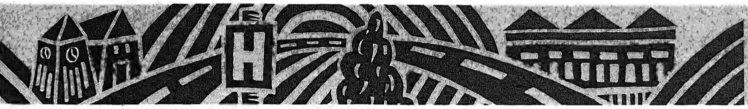
f. Where appropriate Public Sector Bodies could consider using *alternative fuels and combined heat and power* schemes.

g. Of the £1.4 billion capital expenditure which *local housing authorities* in England are spending on renovation of their stock in 1992/93, about one quarter is estimated to be spent on energy related measures. The Green House Programme is demonstrating that higher output from that expenditure could be achieved if best practice were followed. The Programme shows that £2,400 of investment can save 1tonne carbon a year, even when increased internal temperatures are taken into account. In addition to the environmental benefits, improvements to the energy efficiency of the housing stock can provide management and running cost savings, and major benefits for tenants.

There is scope for authorities to make energy efficiency a more integral part of their housing strategies in future, developing programmes for the upgrading of their stock and targets for reductions in CO_2 generation. If existing investment in energy-related measures were to be redirected more fully in line with the lessons emerging from the Green House Programme, around 1 MtC could be saved by the year 2000.

The Government wishes to promote application of the Green House Programme's positive lessons throughout *all* housing authorities. To encourage authorities to consider energy efficiency objectives fully within their repair and improvement programmes, DOE has announced that energy efficiency is to be made a more explicit part of the Housing Investment Programme (HIP) bidding process from 1993 onwards. The Department will issue full technical guidance on this before the start of the next HIP round, drawing on the lessons of the Green House Programme.

In Scotland the Government has made available additional resources totalling £9.5 million over two years to fund energy efficiency projects for local authority housing. In addition Ministers have highlighted to authorities the need to build upon the progress made and authorities are being encouraged to address energy efficiency problems within their mainstream capital programmes for 1993-4 and future years.



h. The *Housing Corporation and housing associations, Housing for Wales and Scottish Homes* could seek to build new houses to above current building regulations standards. A pilot project by BRECSU for the National Federation of Housing Associations has shown that it is possible to build housing association new dwellings at higher standards of energy efficiency than current building regulations broadly within current cost limits. The results are to be disseminated to associations at a number of regional workshops throughout the UK. The Housing Corporation and housing associations could also seek to give energy efficiency a higher profile in ongoing rehabilitation work.

i. Local Authorities should take account of *accessibility by public transport* to new developments. They should look at local transport policies to ensure that they encourage use of alternatives to the private car, especially public transport, walking and safe cycling eg. by traffic management to limit car use in urban areas and measures to give buses priority.

Your views would be welcome

What further objectives should public sector bodies set themselves?

Should housing organisations set objectives for their housing stock?

What action can be taken to improve the vehicle efficiency of public sector transport fleets?

eight

OPTIONS FOR GOVERNMENT MEASURES

8.1 The previous chapters have looked at the possibilities for individuals, businesses and public sector bodies to take steps voluntarily to reduce the CO_2 emissions for which they are responsible. This chapter looks at what measures the Government might take. As different measures would be needed to tackle transport and non-transport emissions, the options are discussed separately.

8.2 Government action can support and encourage voluntary action, or it can force action through a regulatory approach. Non-regulatory approaches include advice and information, direct financial help, or price-based measures to provide incentives to improvements in energy efficiency and switching to less carbon intensive fuels.

MEASURES OUTSIDE THE TRANSPORT SECTOR

Regulation

8.3 Regulation has been widely used as an instrument of environmental policy, for example to control polluting emissions from industry. It is most useful as an instrument where there are a few clearly defined sources of emissions or where sources are relatively homogeneous and common standards can be applied. This is not usually the case with CO_2 emissions which result from a large number of very different energy uses (and users).

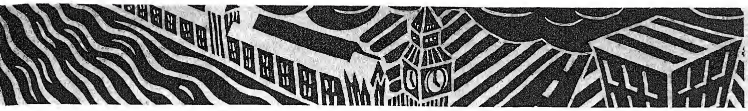
8.4 However there are sources of emissions to which standards can be applied. Appliance standards are one option. The US has introduced standards for energy efficiency in domestic electrical appliances. And in the UK we already have standards for energy conservation in new buildings. These are currently under review. The Government will shortly be consulting on proposed revisions to the building regulations with a view to laying revised regulations by the end of 1993.

8.5 The main option for using regulation to control emissions in the UK would be to introduce standards for individual items or components of energy using equipment. These might cover domestic appliances, lighting, office machines or industrial equipment. Such standards would need to be agreed with other EC Member States (see chapter 6).

8.6 If *all* domestic appliances were replaced by more efficient models, savings of 4 MtC could be achieved. However it would clearly not be cost-effective to replace all appliances in the short term. In the short to medium term a much lower saving would be realistic. Similarly if all the lighting in the country were replaced by energy efficient lighting, savings of 2 MtC could be achieved.

Help for those taking voluntary action

8.7 *Information and Advice* As discussed in chapter 3, the Energy Efficiency Office has a continuing programme of information and advice directed at individuals and businesses. This has helped to underpin the improvements in energy efficiency experienced over the last twenty years and which is expected to continue. Additionally the DTI recently launched an Energy Design Advice Service to provide advice to professionals in the the building industry. Further details are set out in the Annex. The Government intends to ask the Energy Saving Trust (see below) to bring forward proposals for a pilot scheme of local energy efficiency information centres for domestic



and small business energy consumers. These programmes could be further enhanced but, on its own, information and advice is unlikely to have sufficient impact.

8.8 *Financial incentives* Financial incentives can be used to increase the take-up of energy efficiency measures. There are problems associated with the extensive use of subsidies. One is the difficulty of distinguishing energy efficiency investment from more general upgrading of buildings and other capital goods - indeed energy efficiency improvements are often most cost-effective when integrated with normal investment programmes. Another is the high administrative costs of any subsidy scheme and the potential waste of public funds if the investment would have been carried out anyway without the subsidy. And care needs to be taken that the existence of subsidy for certain types of investment does not displace investment away from what would be most cost-effective. Finally a large scale programme of Exchequer subsidies would conflict with the Government's objective of containing public expenditure for wider economic policy reasons.

8.9 Well targeted subsidies may nonetheless have a role to play where there are genuine market barriers, or where it is important to raise the profile of certain energy efficiency investments. Incentives to invest tend to be weakest where energy prices represent a relatively small proportion of overall expenditure, as with many households and small or commercial businesses. The Energy Saving Trust is being set up to provide well-targeted incentives, initially on a trial basis, to encourage the take-up of energy efficiency measures, such as gas condensing boilers and small-scale CHP applications.

8.10 Those on low incomes face the problem that they do not have the funds for even basic energy efficiency measures yet they live in some of the most energy inefficient housing. Help has been made available through the Home Energy Efficiency Scheme (HEES) and through the system of renovation grants.

8.11 Options for the future include providing more assistance through HEES and renovation grants or extending the programmes run by the Energy Saving Trust. A comprehensive programme of schemes run by the Energy Saving Trust on a nationwide basis could make a significant contribution to the reduction in CO_2 emissions needed. At present it is envisaged that the costs of schemes proposed by British Gas will be passed on to consumers through a special addition to the tariff approved by OFGAS. The Director General of Electricity Supply has agreed to adjust the electricity regulatory regime to provide incentives for the electricity industry to contribute to reducing CO_2 emissions. The extent of savings from the Trust's schemes will depend on the level of expenditure. As an illustration, savings of 1-2 MtC would require expenditure of between £150m and £300m a year. This would add around 2-3% to average domestic energy bills if the cost of schemes were entirely funded by consumers (although the effect of the Trust's schemes will be to reduce many individual consumers' bills). The Government hopes that overall, taking information initiatives into account, the new Trust might save 2-3.5 MtC by 2000. It will be considering with the utilities and the regulators how best to achieve this objective.

8.12 Another option would be to give additional capital allowances to encourage industry to make investments which improve energy efficiency. However new equipment is usually more efficient than that it replaces; hence concessions of this nature could be costly and relatively unproductive.

8.13 *Price-Based Measures* Given the widespread nature of CO_2 emissions, it has been suggested that a price based instrument may be the best way of ensuring that all sources of CO_2 emissions contribute to meeting our objective. One such instrument that has been widely discussed is a carbon tax. This would tax fossil fuels according to

their carbon content. It would work by giving an incentive to everyone to cut down on their use of such fuels and to switch to less carbon intensive fuels where this was economic.

8.14 Some countries, including Denmark, Norway and Sweden have already introduced partial taxes of this sort.

8.15 The European Commission has proposed the introduction of an EC-wide combined carbon and energy tax. The Commission proposal is for a tax with equal carbon dioxide and energy components. The energy component would apply both to fossil fuels and to non-CO_2 emitting energy sources such as nuclear power, but sources of renewable energy would be exempt except for hydro plant over 10 MW. The tax would be introduced gradually starting at the equivalent of $3 per barrel of oil and rising to $10 per barrel seven years after introduction. At $10 rates, and compared to recent prices, this would imply price rises for electricity of about 1p a kWh and 0.3p a kWh for gas (representing up to 20% increases on recent prices for domestic users, more for non-domestic users), a 30% rise in the price of domestic coal, and about 3.5p on a litre of petrol (up to 10%). The Commission propose that the tax should only be implemented if other OECD countries have introduced similar taxes or measures with an equivalent financial impact, and that introduction of the tax should be accompanied by measures to ensure that it has a neutral effect on the overall tax burden in each Member State. Studies have suggested that, depending on the method used for recycling the revenues, the overall economic impact on output growth of a carbon or energy tax of the size proposed by the Commission could be relatively small once the economy had had time to adjust to the new prices. However there would inevitably be short run dislocation costs.

8.16 Preliminary modelling work undertaken earlier this year indicated that, if introduced without any exemptions, a tax along the lines proposed by the Commission might stimulate reductions in emissions amounting to around 10 MtC in the UK by the year 2000, and that a carbon only tax might have a bigger effect than a combined carbon/energy tax set at the same level. However this assumed savings arising from fuel switching in the electricity generating sector accounting for around one quarter of the possible emission reductions from a tax as proposed by the Commission (and a higher proportion of the possible reductions from a carbon only tax).

8.17 A carbon or carbon/energy tax would be likely to have the greatest impact on energy use by industry. Of the emission savings brought about by the Commission's proposed tax about half could come from reductions in energy use by industry. Individuals tend to be less sensitive to changes in energy prices in the short to medium term. However low income groups spend a greater proportion of their income on energy than the average. In considering whether or not such a tax should be introduced the Government would need to be satisfied that it would not have unacceptable impacts on any particular group of households or on the competitive position of UK industry (which might simply displace CO_2 generating activities to other countries). The Government has also separately sought the views of industry and other interested groups on the Commission's proposals.

Stimulating Renewable Energy

8.18 The Government has been working towards a figure of new renewable electricity generating capacity of 1000 MW by the year 2000. The strategy for achieving this figure is based on a comprehensive research, development, demonstration and deployment programme to facilitate market forces, together with the Non-Fossil Fuel Obligation (NFFO) which obliges electricity suppliers in England

and Wales to purchase set amounts of electricity from non-fossil fuel sources. Two Renewables Orders have so far been laid. The implied increase in the use of renewable energy sources has been taken into account in the projections of CO_2 emissions discussed in chapter 3.

8.19 Various commentators have suggested that this could be increased. The Energy Select Committee recommended that the Government adopt a target for new renewable generating capacity "which is both challenging and attainable" and suggested that the Government should pay particular attention to the proposals received by the Committee for a target in the 3000 - 4000 MW range. The Renewable Energy Advisory Group was established in 1991 to advise the President of the Board of Trade on the Government's renewable energy strategy. Its report will be published shortly. The Secretary of State for Scotland is discussing with interested parties the introduction of a Scottish Renewables Obligation.

8.20 Increasing NFFO support for renewable energy would increase energy prices. For example adding a further 1000 MW would save around 1 MtC of CO_2 emissions and, depending on the technologies chosen, add about 1-2% to electricity bills, assuming the increase was entirely funded through the fossil fuel levy. A carbon tax or a carbon/energy tax of the sort proposed by the Commission could also provide a stimulus to renewable energy sources.

TRANSPORT

8.21 Increasing demand for fuel for road transport is the main reason for the projected increase in CO_2 emissions by the year 2000. Chapters 4 and 5 have discussed ways in which individuals and businesses could help to limit this growth in emissions, by choosing more fuel efficient vehicles or modes of transport, driving carefully and not making unnecessary journeys. As with other sources of emissions Government action could try to encourage such voluntary measures by persuasion or by changing relative prices, or could take the form of regulation.

8.22 *Regulation* Regulations in the form of emission standards for vehicles would be difficult to formulate as CO_2 emissions vary considerably between vehicles depending on the type of vehicle, its size, weight, engine type and design. Regulation would tend to restrict the choices available to the motorist and the manufacturer. A system which required manufacturers to achieve specified improvements averaged across the whole of their product range would be an option. Such a system was introduced in the US but suffered from being too inflexible and because it unduly constrained choices. The UK Government proposed a more flexible market based system of regulation in the European Community incorporating a mechanism for trading between manufacturers, but this idea has not been supported by other EC Member States.

8.23 Regulation could also be targeted on specific aspects of car design. One of the most important determinants of fuel consumption is speed. Speed limiters are already compulsory on coaches and new heavy goods vehicles. Requiring speed limiters to be fitted to all new cars to prevent the maximum speed limit being exceeded could save up to 1 MtC. Unilateral action by the UK would be likely to conflict with EC treaty obligations on the free movement of goods, so agreement would be needed in the EC, but there seems little prospect of early agreement.

8.24 *Information and Advice* Information and advice is already available about the fuel efficiency of different vehicles and about fuel efficient driving techniques. However this tends to be outweighed by other factors determining choice of car and driving style and, unless backed up by regulatory or financial measures, further efforts may not be cost-effective.

8.25 *Price-Based Measures* Price-based measures are one way of reducing transport emissions. Such measures allow the motorist and the manufacturer to make adjustments at minimum cost since they are able to select the most appropriate action to save a given amount of CO_2, consistent with their particular circumstances. In the past there has been a clear correlation between real fuel prices and improvements in average fuel efficiencies of new vehicles. Higher fuel prices would provide a stimulus to motorists to buy, and manufacturers to produce, new cars with greater fuel economy. It would also encourage car owners to drive more carefully and to cut out unnecessary journeys. For example a 10% increase in real fuel prices by 2000 could lead to a saving of up to 1 MtC.

8.26 Another option would be to reflect fuel efficiency in the price of cars. This would provide a direct incentive to consumers to buy more fuel efficient cars. But, by itself it would encourage some increase in travel since more fuel efficient cars would be cheaper to run.

8.27 Other measures could also help to reduce transport emissions by *reducing the demand for travel.* For example the Department of Transport is currently conducting research into the possibility of using road pricing in towns and cities to tackle congestion problems, and this research will assess the potential environmental impacts of road pricing. A Green Paper on charging for inter-urban roads will be published next year. It will take account of environmental impacts. The Departments of Environment and Transport have set in hand research to look at the relationship between land use and transport demand. The results will be published shortly. Some advice has already been given to local planning authorities on ways in which development patterns can minimise private car use.

8.28 Most forms of public transport, provided they are reasonably loaded, have lower fuel consumption and hence CO_2 emissions per passenger kilometre than the private car. Switching journeys from cars to public transport would therefore generally help to reduce CO_2 emissions. The Government provides subsidies to maintain British Rail's Network SouthEast and Regional railway services and London transport services. Local authorities subsidise some bus and rail services. However research shows that the provision of public transport by itself is not enough to encourage travellers to switch from cars. It has to be combined with a disincentive to car use, which might be traffic management measures to limit car use in urban areas, or higher fuel prices.

SUMMARY OF MAIN OPTIONS FOR GOVERNMENT MEASURES [16]

Extension of Energy Saving Trust plus related information initiatives ~ Savings of 2-3.5 MtC possible. Would add about 3% to domestic energy bills

Standards for energy using equipment ~ Savings of up to 2 MtC possible. Requires EC agreement. Costs would be offset by energy savings to consumers

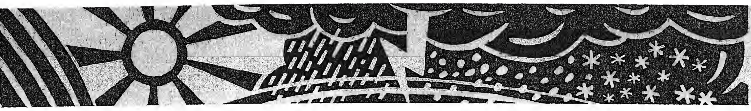
Carbon/energy tax as proposed by European Commission ~ Could achieve savings of about 10 MtC. A carbon only tax would be likely to achieve greater savings than a carbon/energy tax set at the same level

Increased NFFO ~ Limited potential up to 2000. Savings of 1 MtC would add around 1-2% to electricity prices

Speed limiters for cars ~ Could save up to 1 MtC. Some additional costs for car manufacturers. Requires EC agreement

Transport fuel price rises ~ 10% increase in real fuel prices would save up to 1 MtC

Reflecting fuel efficiency in vehicle price ~ Savings of about 1-2 MtC possible by 2000



nine

THE NATIONAL PROGRAMME

9.1 Our national programme will need to show clearly what measures we are taking to limit CO_2 emissions and the effect these will have on the underlying projections (the Convention text refers to a "detailed description of policies and measures"). For our own domestic purposes the programme must make clear who is responsible for taking each measure in the programme. And the programme must be in a form that will allow us to monitor progress and have sufficient flexibility to allow it to be updated and modified if necessary. This chapter looks at the overall form and possible composition of the programme.

FORM OF THE PROGRAMME

9.2 The programme must have three basic components

- the central projection of emissions (and the range of uncertainty associated with this projection)
- the measures that will be taken to reduce emissions
- the estimated effect these will have on projected emissions

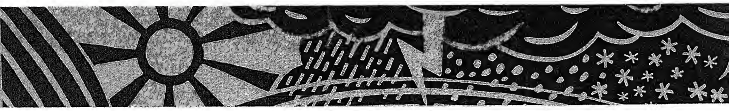
9.3 To help everyone understand how they might contribute to the overall objective it will be helpful to distinguish between the main sectors - individuals, industry/commerce and the public sector. The following table summarises projected emissions under a central scenario, based on Energy Paper 59, by sector.

Table 9.1: Summary of past trends and projections by sector: MtC

	1970	1980	1990	2000	2005	2020
Households	54	48	41	41	42	42
Industry	85	64	56	58	61	71
Commerce	10	11	14	18	} 30	45
Public sector	10	12	10	9		
Transport, of which:	23	29	38	45	49	62
Individuals	11	15	21	25	28	36
Industry/commerce	6	8	11	13	14	19
Public transport [17]	6	5	6	7	7	8
TOTAL	182	165	160	170	183	221

9.4 In drawing up the national programme the Government will want to have regard to some key principles:

- the savings should be found in the most cost effective way possible.
- the programme should maximise the potential for savings to be achieved without Government intervention.
- where Government action is needed, economic instruments are preferable to regulation.
- the Programme should be consistent with the Government's policy for the energy sector.
- the Programme should be consistent with the Government's objectives and priorities for public expenditure.
- the Programme should be sufficiently flexible to allow for review as progress towards 2000 is monitored.



THE POTENTIAL CONTRIBUTION OF VOLUNTARY ACTION

9.5 As discussed in chapter 3, the emission projections shown above already assume continuing improvements in energy efficiency in line with past trends, amounting to some 7% of current non-transport emissions. Further savings could be made cost-effectively. If, as a result of the sort of actions discussed in chapters 4-7, energy users were able to increase energy efficiency savings to 10% of current emissions, this would contribute CO_2 savings of 3 MtC.

9.6 The Government would welcome views on the extent to which energy efficiency can be improved by voluntary action with no change in energy prices. However the Government's preliminary view is that without further incentives voluntary action alone is unlikely to be sufficient to meet the overall objective.

THE OPTIONS FOR GOVERNMENT MEASURES

9.7 The options for Government measures to supplement voluntary action are summarised at the end of chapter 8. Some measures will require agreement in the EC, subject to the principle of subsidiarity. The Government will therefore need to consider carefully the prospects for such agreement before deciding the overall package of measures. And the Government will need to be satisfied that the programme will not have unacceptable impacts on any particular group of households or on the competitive position of UK industry (which might simply displace CO_2 generating activities to other countries). Decisions on the programme as a whole will be taken in the light of decisions taken pursuant to the Coal Review announced by the President of the Board of Trade.

ILLUSTRATIVE COMBINATION OF OPTIONS

9.8 The following examples illustrate two possible ways in which savings of 10 MtC might be achieved. At this stage they are to be regarded as purely illustrative and not as proposals.

Example A

Investment in Energy Saving Trust together with new information initiatives is sufficient to achieve savings of 2-3 MtC. Balance of savings is found by stimulating further action through carbon or carbon/energy tax.

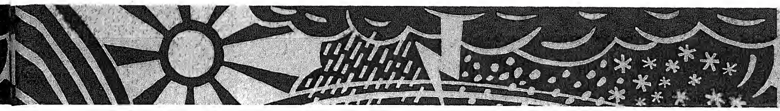
Under this option the energy and gas utilities would need to agree with the Government and the regulators programmes of investment through the Trust amounting to around £300m a year. This would need to be supplemented by a nationwide information initiative. A carbon or carbon/energy tax could then be set at a level that would achieve savings of some 7-8 MtC.

Example B

Commitments are made to increase trend improvement in energy efficiency to achieve additional savings of 3 MtC. No carbon/energy tax. Balance of savings found through:

- support for energy efficiency investment through the Energy Saving Trust, and related information initiatives (2-3 MtC),
- new standards for energy efficiency of equipment (1 MtC),
- additional support for renewables (1 MtC),
- measures to reduce transport emissions (2-3 MtC)

In this example transport fuel prices might need to rise by 3% a year in real terms, support for renewables and energy efficiency investment would add 4-5% to average domestic electricity and gas bills. The cost of goods to which the new energy efficiency standards applied would be expected to rise. The effect on car prices would be mixed. EC agreement would be needed for the new standards for equipment and for speed limiters.



ten

BEYOND 2000

10.1 The Framework Convention contains specific aims for emission levels for the year 2000 only. However the Convention's stated objective is ultimately "to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Convention therefore contains provision for further commitments to be agreed periodically, going beyond 2000. The commitments must be reviewed at the first meeting of the Convention's conference of parties, again not later than the end of 1998, and periodically thereafter.

10.2 Any measures adopted as part of our national programme for the year 2000 will continue to limit emissions beyond 2000. It would be possible to strengthen these measures to meet any commitments agreed for the next century but, in the longer term, developing technologies may alter the relative cost-effectiveness of different measures. The Government is continuing research into different ways of limiting emissions, including the exploitation of alternative non-fossil energy souces.

RENEWABLE ENERGY

10.3 The Government is supporting a major research, development, demonstration and deployment programme on new and renewable sources of energy, currently amounting to around £24 million annually. The aim of this programme is to stimulate the development of renewables to the fullest practical extent where they have prospects of being economically attractive and environmentally acceptable. The Government's strategy on renewable energy was published in 1988 as Energy Paper 55, and that strategy is currently being reviewed. Energy Paper 55 included estimates of the amount of renewables-based electricity that could conceivably be achieved by 2025, assuming that all of the required research is successful. The estimated range was up to 25% of the current UK electricity demand.

NUCLEAR POWER

10.4 There will be a review of nuclear power in 1994. The review will take into account the potential environmental costs and benefits of nuclear power.

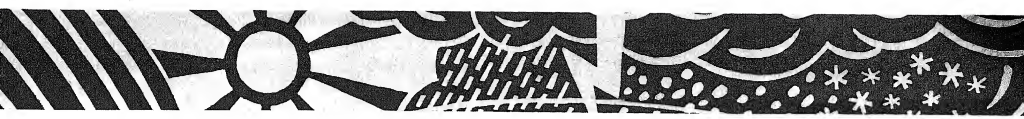
TRANSPORT

10.5 On current projections transport would remain the fastest growing source of CO_2 emissions beyond 2000. The Governments' National Road Traffic Forecasts (NRTF) published in 1989 predict that, on broadly unchanged policies and using standard assumptions about economic growth, road traffic will increase by between 69% and 113% by 2025 compared with 1991. The recent slowing in traffic growth is expected to be followed by a return to more normal growth as the economy recovers with faster growth on inter-urban roads than on urban roads. Higher growth is expected where economic activity and population are growing faster than the national average.

10.6 The NRTF do not represent a target which the Government is aiming to meet. As noted in paragraph 8.27, the Government is currently considering a number of initiatives which could have the effect in the longer term of reducing the rate of traffic growth, including measures to reduce congestion on urban roads. An increase in fuel duties, as discussed in chapter 8, could have an impact on traffic growth.

10.7 One issue being considered is the role of land use planning. This could affect the growth in demand for car transport in the longer term. Advice will be given to local planning authorities in a new Planning Policy Guidance Note on Transport and Planning, reflecting the findings of recent research. Developments in telecommunications may also have a dampening effect on the growth in transport. The effect will depend on the balance of advantages as perceived by businesses between cost savings from telecommunications and the benefits of face to face meetings. Teleworking is another area where there is likely to be significant growth in the future - although the effects on CO_2 emissions are likely to be mixed, with reductions in some trips and increases in others.

10.8 The Department of Transport's Transport Research Laboratory (TRL) is reviewing national and international research and experience in the use of a wide range of alternative fuels and engines for road vehicles. The review is nearing completion. The findings will provide the foundation for further related research on alternative fuels.



ANNEX: CURRENT ACTION TO REDUCE CO_2 EMISSIONS

Much action is already in hand to limit CO_2 emissions in all sectors of the economy. A detailed list of the key actions which are being taken or encouraged by the Government is given below. Savings from these actions have been generally included in the underlying projections of emissions to 2000 set out in chapter 3. The exceptions are the Energy Saving Trust, the new Energy Management Assistance Scheme and the proposed revision to the building regulations, which together could reduce emissions below their projected level by some 3-5 MtC by 2000. This estimate is dependent on the level and type of investment funded through the Trust.

Current Action to help individuals to reduce emissions attributable to energy use in the home:

Publicity: Individual householders are already being encouraged to save energy through the "*Helping the Earth Begins At Home*" publicity campaign, which aims to raise awareness of the link between global warming and energy use at home. The campaign has been running national TV and press advertisements. It is aimed primarily at existing dwellings and initially at home-owners.

Advice: The Energy Efficiency Office's Best Practice programme provides authoritative advice on cost-effective measures in buildings for building professionals and local authorities engaged in construction, refurbishment and maintenance of housing.

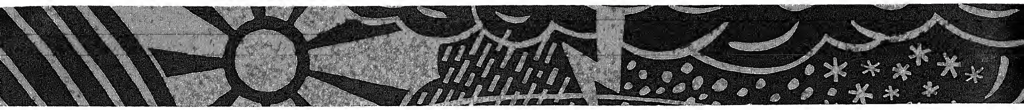
Energy Saving Trust: A new independent Trust has been set up as a joint partnership between the Government, British Gas, the Regional Electricity Companies, Scottish Power and Scottish Hydro Electric. It will run new schemes to encourage, householders and small businesses to take-up energy efficiency measures. Depending on the amount and type of investment funded through the Trust, the Trust's new schemes supplemented by a nationwide information initiative could save some 2-3.5 MtC by 2000.

Public Sector Housing Improvements: Public sector housing contributes about 8.45 MtC each year (5% of UK CO_2 emissions). To demonstrate the importance of beginning to tackle this, the Government has provided funds of £60 million over three years in England for the Green House Demonstration Programme, which is successfully showing the scope that exists for energy efficiency measures to reduce both carbon dioxide emissions and fuel costs in council housing. Extra resources, totalling £9.5 million over two years, have also been made available for energy efficiency projects in Scottish local authority housing. The Government proposes that good practice derived from the Green House Programme should inform public sector housing strategies and become an important, integral part of the annual Housing Investment Programme process in England from 1994/95 onwards. This should improve effectiveness in the use of the significant resources that local authorities already devote to energy related measures through their regular repair and maintenance programmes, including Estate Action schemes.

Domestic energy efficiency improvements are also being funded through Housing Action Trusts, through City Challenge, and for those on low incomes, through the House Renovation Grant System and through the Home Energy Efficiency Scheme.

Home Energy Labelling: Energy labels are a way of finding out how energy efficient a home is. A label not only shows the 'energy performance' of a home, but also how cost effective energy saving improvements can improve the rating. This enables energy bills to be reduced and, consequently, CO_2 emissions to be abated. There are currently two bodies operating labelling schemes, and the Government introduced a Standard Assessment Procedure (SAP) to enable the schemes to be compared. The Government is actively promoting home energy labels. Approaches have been made to energy utilities, estate agents and mortgage lenders to encourage them to incorporate home energy labels into their commercial activities. It is hoped that home energy labels will become an increasingly important aspect of home purchase and home improvement decisions. Home energy labelling is also featured in the "Helping the Earth Begins At Home" publicity campaign.

Building Regulations: The new 1990 Building Regulations will achieve a 20% improvement in the energy efficiency of new houses. The Government will shortly be consulting on proposals to strengthen the requirements of the Regulations and incorporate energy labelling of houses, with a view to laying revised Regulations before Parliament by the end of 1993.



Current Action to reduce emissions attributable to energy use by industry and commerce, and the public sector:

Top Management Commitment: To ensure that energy efficiency improvements are given priority, the Government launched its energy efficiency campaign aimed at top management - "Making A Corporate Commitment". This urges company directors and chief executives in public sector bodies to sign a Declaration of Commitment to responsible energy management under which they agree to undertake the following actions:

- publish a corporate policy;
- establish an energy management responsibility structure;
- increase awareness of energy efficiency among employees;
- hold regular reviews;
- set performance improvement targets;
- monitor and evaluate performance levels;
- report performance changes and improvements to shareholders/board/authority members and employees.

Over 900 organisations have signed up. Companies and public sector bodies who sign the commitment will be asked to monitor their progress in meeting their energy targets.

Best Practice Programme: The Energy Efficiency Office's Best Practice Programme researches and provides authoritative advice on and promotes cost-effective energy efficiency measures for industry and commerce. The programme has a target of achieving energy savings in industry and commerce of up to 2 MtC of companies' CO_2 emissions by 2000.

The Energy Design Advisory Service managed by the Royal Incorporation of Architects in Scotland has successfully provided detailed technical advice on energy matters at the design stage of construction projects to developers and consultants for several years. In March 1992 the Government launched a national £7m Design Advice Scheme funded by the DTI's renewable energy programme. The scheme aims to improve the market penetration of proven energy efficiency and passive solar measures and expertise throughout the building design industry.

Energy Management Assistance Scheme: In the small business sector, the Government has made start-up funding for consultancy advice on the design and implementation of energy efficiency projects available through the DOE/EEO "Energy Management Assistance Scheme".

Practical Energy Saving Guide for Smaller Businesses: The DOE/EEO and ACBE have produced a "Practical Energy Saving Guide for Smaller Businesses". The DOE/EEO is also developing pilot local energy advice centres for small businesses and householders.

Transport

Action to encourage more economical use of fuel by road transport includes:

the average duty on road fuel has been increased above the rate of inflation over the last few years

an emissions check has been introduced into the MOT test which encourages people to keep their engines in tune

speed limiters have been required for new heavy lorries since August 1992 and will be required for many of the existing heaviest lorries from August 1993

advice on fuel economy for drivers has been improved and extended

The Government is also supporting high investment in rail and is working with the bus industry and local authorities on ways to make bus travel more attractive eg through local traffic management measures to speed up journey times.

Advice has been given to local planning authorities on how development patterns can minimise private car use and hence CO_2 emissions, for example in PPG 12 and revised PPG 4 (industrial and commercial development). A draft revision of PPG 6 on town centres has been issued for consultation.

NOTES

1 Most of the remaining emissions come from cement manufacture and waste incineration

2 CO_2 emissions are normally measured according to their carbon content, in million tonnes of carbon (MtC). One tonne of carbon is equivalent to 44/12 or 3.67 tonnes of carbon dioxide

3 Fuel processing emissions are allocated to the end user of the energy in proportion to energy consumption

4 Source: Warren Spring Laboratory, DOE

5 Includes railways, shipping within 12km of the coast and aircraft movements below 1km

6 Energy Paper 59 gives CO2 emissions by source (that is according to where the fuel is first used). For this table and in the rest of the document emissions from the electricity supply, oil refining and other fuel processing industries have been allocated to the end user of the energy

7 The trends are discussed in more detail in "A Reference Scenario for Energy Use and CO_2 Emissions by the Residential Sector in the UK", G Henderson and L Shorrock, in Vol. 9 of Proceedings of the American Council for an Energy Efficient Economy (ACEEE), Summer Study on Energy Efficiency in Buildings, Asilomar, California, August 1992 (available from BRE)

8 End use analysis undertaken for the Government by BRE, normalised as necessary to national Air Emissions Inventory and EP59, central growth/low energy price scenario

9 Includes journeys to and from work. Excludes journeys made in the course of work

10 See "Industrial Energy Markets: Energy Markets in UK Manufacturing Industry, 1973-1988". Number 9 in Energy Efficiency Series. Department of Energy, 1989

11 Includes public sector use of transport

12 Includes catering and air conditioning

13 Excludes agriculture, non-energy CO_2 emissions and CO_2 from fuel exports

14 Glass, cement, bricks, refractories and other mineral products

15 Number 13 in the Energy Efficiency series, published in November 1990

16 Not all measures are additive

17 Includes bus and rail transport, shipping within 12km of the coast and aircraft movements below 1km

LIST OF ABBREVIATIONS

ACBE	Advisory Committee on Business and the Environment
BiE	Business in the Environment
BRE	Building Research Establishment
BRECSU	Energy Conservation Support Unit Building Research Establishment
CBI	Confederation of British Industry
CHP	Combined heat and power
CO_2	Carbon dioxide
DOE	Department of the Environment
DoT	Department of Transport
DTI	Department of Trade and Industry
EC	European Community
EEO	Energy Efficiency Office
EP 59	Energy Paper 59
ETSU	Energy Technology Support Unit
GDP	Gross Domestic Product
G7	Group of the seven major industrialized countries
HEES	Home Energy Efficiency Scheme
IOD	Institute of Directors
kgC	Kilograms of carbon
kWh	Kilowatt hours
MtC	Million tonnes of carbon
MW	Megawatt
NA	Not applicable or not separately available
NFFO	Non-Fossil Fuel Obligation
NRTF	National Road Traffic Forecasts
OFFER	Office of Electricity Regulation
OFGAS	Office of Gas Supply
PPG	Planning Policy Guidance
UK	United Kingdom of Great Britain and Northern Ireland
UNEP/WMO	United Nations Environment Programme/World Meteorological Office

FURTHER READING

This Common Inheritance.
The Second Year Report.
Britain's Environmental Strategy.
Cm 2068.
HMSO October 1992 £21.00

United Nations Framework Convention on Climate Change - not yet published.
INC Secretariat, 16 avenue Jean Trembley,
1209 Geneva

Energy Paper 59
Energy Related Carbon Emissions in Possible
Future Scenarios for the
United Kingdom
HMSO, Publications Centre,
PO Box 276 , London SW8 5DT.
ISBN 0114141576 October 1992 £9.99

Intergovernmental Panel on Climate Change -
IPCC First Assessment Report 1990 ISBN
0521407206 £17.95/ Supplementary Report
1992 ISBN 0521438292 £9.95.
Cambridge University Press.

Warren Spring Laboratory
Digest of Environmental Protection and Water
statistics 14 1991
HMSO ISBN 0117526347 £13.50
UK Emissions of Air Pollutants
1970-1990 - June 1992
Warren Spring Laboratory Library,
Gunnels Wood Road, Stevenage,
Hertfordshire, SG1 2BX.
Tel 0438 741122

Department of Transport "New car fuel consumption guide"
VCA, The Eastgate Centre, Eastgate Road,
Bristol, BS5 6XX

"Fuel Management Guide"
The Freight Transport Association
Hermes House, St Johns Road,
Tunbridge Wells, Kent TN4 9UZ
Tel 0892 526171

Advisory Committee on Business and the Environment "A Guide to Environmental Best Practice for Company Transport"
Department of the Environment,
PO Box 135, Bradford,
West Yorks BD9 4HU
Fax 0274 530130

ACBE/EEO "Practical Energy Saving Guide for Smaller Businesses"
Department of the Environment,
Energy Efficiency Office, 1 Palace Street,
London SW1E 5HE
Tel 071-276 3116

FURTHER INFORMATION

EEO Best Practice Programme
Energy Efficiency Enquiries Bureau,
Energy Technology Support Unit (ETSU),
Harwell, Oxfordshire OX11 0RA
Tel 0235 436747

OR

Enquiries Bureau
Building Research
Energy Conservation Support Unit (BRECSU)
Building Research Establishment,
Garston, Watford WD2 7JR
Tel 0923 894040

EMAS
Department of the Environment,
The Energy Efficiency Office,
1 Palace Street, London SW1E 5HE.
Tel 071-238 3116

Home Energy Efficiency Scheme
Department of the Environment,
The Energy Efficiency Office,
1 Palace Street, London SW1E 5HE.
Tel 071-238 3453

"Making a Corporate Commitment" campaign
Campaign Unit,
The Energy Efficiency Office,
1 Palace Street, London SW1E 5HE.
Tel 071-238 2999

"Helping the Earth Begins at Home" campaign
PO Box 200, Stratford-upon-Avon,
Warwickshire, CV37 9ZZ
Tel 0345 247 347

CREATE
41 Station Road, Colwyn Bay,
Clywd, LL29 8BP

Advisory Committee on Business and the Environment (ACBE)
c/o The Department of the Environment,
Global Atmosphere Division, Room B247,
Romney House, 43 Marsham Street,
London SW1P 3PY
Tel 071-276 8449